European countries have been required to check environmental air quality and measure any airborne pollutants that could endanger human health since 1996. Yet for many governmental and scientific institutions, meeting these targets with traditional air-sampling methods has been a challenge, with equipment that can be difficult to calibrate and sometimes prone to breakdown. The European Union (EU)-funded research project MOSSCLONE is developing a radical alternative to existing air-sampling methods, one that is easy and cheap to implement – the use of moss.

“Mosses have been used for decades to monitor air quality,” says project coordinator José Ángel Fernández from the University of Santiago de Compostela in Spain. “Mosses lack a root system, so they rely on deposition from the atmosphere for their mineral nutrition. They are especially well-suited for air-quality assessment as they are very effective at trapping pollutants, both particulate and gaseous,” he adds.

The MOSSCLONE team's major achievement has been to develop a man-made clone of terrestrial moss, which is as capable as its biological brother to detect gaseous and particulate pollutants reliably and effectively, even after its devitalisation. In addition, the team has come up with a standardised methodology, a large-scale cultivation process for the material, and an industrial-scale production approach for the container of the devitalised-moss bag, the basis of this pollution-measuring method.
“Traditional air-pollution measurement systems require a range of detectors to measure the presence of different pollutants,” explains Fernández. “However, moss simply retains all the different pollutants within its structure, so it is easily processed to measure their presence. The absorption process itself is also a passive one – it needs no electricity supply or complex equipment to function. The moss-bag method can be used anywhere – traditional methods cannot,” he says.

The team has put extensive effort into ensuring that the MOSSCLONE method is economically practicable and straightforward to use. The devitalised-moss bags that form the basis of the measurement system are cheap and easy to produce and will adsorb pollutants without consuming energy or emitting contaminants. Moss cultures are also relatively easy to manufacture at industrial production levels – they require little energy and a minimal amount of water, while generating mostly organic and biodegradable waste products.

The MOSSCLONE approach has been tested in three European regions, each in a different climate zone. They are Galicia in the north-west of Spain, Campania in the south of Italy and Austria. Differing sampling locations have been used to check the ambient air quality and any air pollution at a variety of sites: clean natural habitats, industrial areas, urban environments etc.

Standardisation has been a key theme within the project. The moss-bag, the container, the moss-cultivation process have all been designed so that the approach can be used Europe-wide and ultimately even worldwide. In this way, measurements taken with the moss-bags will be comparable across Europe. Such consistent measurement capabilities are expected to make it much easier for European countries to identify potential air-pollution risks, whether they are to human health, agricultural crops, natural ecosystems or more. Early identification of such risks could enable timely implementation of changes or corrections to environmental policies, before the adverse consequences of excessive pollution arise.

But just how mobile is the measuring equipment? Is it easily portable? In the words of Fernández: “as well as proving that we can manufacture the moss-bag and container on an industrial scale, we have produced a prototype measuring device. It fits into one hand, and weighs less than one hundred grams.”

See also:
CORDIS [2]

Project:
Creating and testing a method for controlling the air quality based on a new biotechnological tool. Use of a devitalized moss clone as passive contaminant sensor

Project Acronym:
MOSSCLONE


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